A 42-year-old man visits his doctor after his cousin, who has not seen him for years, notices a change in his appearance. Overgrowth of his frontal bones and enlargement of his hands and feet have occurred. The patient complains of a tingling sensation in the 1st, 2nd, and 3rd digits of the right hand and loss of coordination and strength of the right thumb. Which of the following nerves has most likely been affected?

A. Anterior interosseous nerve

B. Median nerve

C. Musculocutaneous nerve

D. Radial nerve

E. Ulnar nerve

Explanation:

The correct answer is B. This patient has acromegaly, which is characterized by overgrowth of the face, jaws, hands, and feet, enlargement of internal organs,; hyperglycemia,; hypertension, and osteoporosis. It is caused by hypersecretion of growth hormone, often attributed to an adenohypophyseal tumor. Complications include degenerative joint disease, muscular weakness, neuropathies, and diabetes mellitus. In this question, though the patient's sensory symptoms may be caused by a neuropathy, it is very likely that overgrowth in the wrist area has compressed the carpal tunnel, thereby impinging on the median nerve. Note that the median nerve (root C5-T1) provides motor innervation to the forearm flexors, thenar muscles, and radial lumbricals. It provides sensory innervation to the radial 2/3 of the palm, volar surfaces of the thumb, 2nd and 3rd digits, and radial 1/2 of the 4th digit.

Damage to the anterior interosseus nerve (choice A), also known as the deep branch of the median nerve, results in the inability to form a round "O" with the thumb and forefinger. This is due to impaired function of the flexor pollicis longus. Damage to the anterior interosseus nerve could explain the patient's thumb dysfunction, but it would not account for the patient's paresthesias in the first three digits of the hand.

The musculocutaneous nerve (choice C) innervates the arm flexors and provides sensory information to the anterolateral forearm. It is composed of contributions from C5-7.

The radial nerve (choice D) innervates the extensors of the arm and forearm and skin of the posterior arm, forearm, and radial half of the dorsum of the hand (not including the fingertips). It is composed of contributions from C6-8.

The ulnar nerve (choice E) provides motor innervation to the ulnar flexors, adductor pollicis, hypothenar muscles, interosseus muscles, and lumbricals 4 and 5. It provides sensory innervation to the ulnar half of the wrist, palm, and 4th and 5th digits. It is composed of contributions from C8-T1.

A large tumor mass impinges on the splenic artery and its branches as the artery passes out from below the greater curvature of the stomach. Branches of which of the following arteries would most likely be affected by the pressure on the splenic artery?

A. Left gastric

B. Left gastroepiploic

C. Right gastric

D. Right gastroepiploic

E. Short gastric

Explanation:

The correct answer is E. The splenic artery passes behind the stomach and gives off the short gastric artery and the left gastroepiploic artery immediately after passing the greater curvature. The left gastroepiploic artery has a strong anastomotic connection to another arterial supply while the short gastric does not, so the area supplied by branches of the short gastric arteries is more vulnerable to ischemia in this setting. If the block had occurred proximal to, instead of at the branch point, the short gastric vessels could be supplied by backflow from the left gastroepiploic artery.

The left gastric artery (choice A) is not supplied by the splenic artery.

The left gastroepiploic artery (choice B) can be alternatively supplied by its anastomotic connection to the right gastroepiploic artery.

The right gastric artery (choice C) is not supplied by the splenic artery.

The right gastroepiploic artery (choice D) is normally supplied by the gastroduodenal artery.

A patient complains to his physician that his thumb "doesn't work right." The physician notes weakness of the thumb in extension, although rotation, flexion, abduction, adduction, and opposition are normal. Which of the following nerves is most likely involved?

A. Median and radial

B. Median and ulnar

C. Median only

D. Radial only

E. Ulnar only

Explanation:

The correct answer is D. All three of the nerves listed innervate muscles that supply the thumb. Extension is provided by the extensors pollicis longus and brevis, which are innervated by the radial nerve.

The median nerve (choices A, B, and C) supplies the thenar group, which allows the thumb to oppose, flex, abduct, and rotate.

The ulnar nerve (choices E and B) supplies the adductor pollicis, which adducts the thumb.

An inexperienced resident examines the x-ray of the arm of a child after a fall. There appears to be a fracture near, but not at, the distal end of the ulna. Before diagnosing a fracture, the resident should also consider the possibility that this is actually which of the following?

A. Articular cartilage

B. Epiphyseal plate

C. Perichondrium

D. Primary ossification center

E. Secondary ossification center

Explanation:

The correct answer is B. The epiphyseal plate of the bone contains cartilage that is radiolucent. The plate in a bone that is not yet fully ossified can produce a "line" crossing the bone near the end. This may be easily mistaken for a fracture by the inexperienced.

Articular cartilage (choice A) is radiolucent, but occurs at the very tip of the long bones.

Perichondrium (choice C) is usually difficult to see on x-ray.

Primary (choice D) and secondary (choice E) ossification centers are radiopaque.

A 63-year-old man complains of trouble swallowing and hoarseness. On physical exam, he is noted to have ptosis and a constricted pupil on the left, and a diminished gag reflex. Neurological examination shows decreased pain and temperature sensation on the left side of his face and on the right side of his body. Which of the following vessels is most likely occluded?

A. Anterior inferior cerebellar artery (AICA)

B. Anterior spinal artery

C. Middle cerebral artery (MCA)

D. Posterior cerebral artery (PCA)

E. Posterior inferior cerebellar artery (PICA)

Explanation:

The correct answer is E. The signs and symptoms in this patient are consistent with occlusion of the posterior inferior cerebellar artery (PICA). PICA is a branch of the vertebral artery (which is itself a branch of the subclavian artery). Occlusion of PICA causes a lateral medullary syndrome characterized by deficits in pain and temperature sensation over the contralateral body (spinothalamic tract dysfunction); ipsilateral dysphagia, hoarseness, and diminished gag reflex (interruption of the vagal and glossopharyngeal pathways); vertigo, diplopia, nystagmus, and vomiting (vestibular dysfunction); ipsilateral Horner's syndrome (disruption of descending sympathetic fibers); and ipsilateral loss of pain and temperature sensation of the face (lesion of the spinal tract and nucleus of the trigeminal nerve).

AICA (choice A) is a branch of the basilar artery. Occlusion of this artery produces a lateral inferior pontine syndrome, which is characterized by ipsilateral facial paralysis due to a lesion of the facial nucleus, ipsilateral cochlear nucleus damage leading to sensorineural deafness, vestibular involvement leading to nystagmus, and spinal trigeminal involvement leading to ipsilateral pain and temperature loss of the face. Also, there is ipsilateral dystaxia due to damage to the middle and inferior cerebellar peduncles.

The anterior spinal artery (choice B) is a branch of the vertebral artery. Occlusion produces the medial medullary syndrome, characterized by contralateral hemiparesis of the lower

extremities and trunk due to corticospinal tract involvement. Medial lemniscus involvement leads to diminished proprioception on the contralateral side, and ipsilateral paralysis of the tongue ensues from damage to the hypoglossal nucleus.

The MCA (choice C) is a terminal branch of the internal carotid artery. Occlusion results in contralateral face and arm paralysis and sensory loss. Aphasia is produced if the dominant hemisphere is affected, left-sided neglect ensues if the right parietal lobe is affected, and quadrantanopsia or homonymous hemianopsia occur when there is damage to the optic radiations.

The PCA (choice D) arises from the terminal bifurcation of the basilar artery. Occlusion results in a homonymous hemianopsia of the contralateral visual field. Often, there is macular sparing.

A neuroscientist is studying the functioning of the hypothalamic nuclei by ablating different parts of a mouse's hypothalamus and then monitoring the animal's behavior. In one such experiment, after ablation, the mouse begins to eat more food and becomes obese over a period of weeks. Which of the following structures was likely destroyed in this experiment?

A. Lateral nucleus

B. Septal nucleus

C. Suprachiasmatic nucleus

D. Supraoptic nucleus

E. Ventromedial nucleus

Explanation:

The correct answer is E. The ventromedial nucleus is thought to be the satiety center of the brain. Bilateral destruction leads to hyperphagia, obesity, and savage behavior. Stimulation inhibits the urge to eat.

Destruction of the lateral nucleus (choice A) results in starvation, whereas stimulation of this nucleus induces eating.

Destruction of the septal nucleus (choice B) produces aggressive behavior.

The suprachiasmatic nucleus (choice C) receives direct input from the retina, and plays a role in controlling circadian rhythms.

The supraoptic nucleus (choice D), along with the periventricular nucleus, regulates water balance and produces antidiuretic hormone (ADH) and oxytocin.

A patient has a large meningioma involving the parasagittal region and falx cerebri. Which of the following neurologic deficits would this mass lesion be expected to produce?

A. Altered taste

B. Leg paralysis

C. Loss of facial sensation

D. Ptosis

E. Unilateral deafness

Explanation:

The correct answer is B. A meningioma of the parasagittal region and the falx cerebri would be located superiorly, between the two hemispheres. In this position, it could compress the sensory (postcentral gyrus) or motor cortex (precentral gyrus) supplying the lower extremities.

Taste (choice A) is supplied by cranial nerves VII, IX, and X. These nerves arise in the brainstem.

Facial sensation (choice C) is supplied by cranial nerve V, the nuclei of which are in the brainstem.

Ptosis (choice D) can be caused by a deficit in cranial nerve III, which arises from the brainstem.

Unilateral deafness (choice E) suggests damage to cranial nerve VIII, which arises from the brainstem.

A physician is performing a cranial nerve examination on a patient. While testing the gag reflex, it is noted that when the right side of the pharyngeal mucosa is touched, the patient's uvula deviates to the right. When the left side of the pharyngeal mucosa is touched, the patient does not gag. Which of the following is the most likely location of his lesion?

A. Left glossopharyngeal nerve and left vagus nerve

B. Left glossopharyngeal nerve only

C. Left vagus nerve only

D. Right glossopharyngeal nerve and right vagus nerve

E. Right glossopharyngeal nerve only

F. Right vagus nerve only

Explanation:

The correct answer is A. The gag reflex requires the glossopharyngeal nerve for the sensory limb of the reflex (unilateral) and the vagus nerve for the motor limb of the reflex (bilateral). A lesion of the left glossopharyngeal nerve will denervate the sensory receptors on the left side of the pharynx. Thus when the left side is touched, the patient does not feel it and does not gag. The gag reflex requires the vagus nerve for the motor limb of the reflex. If the left vagus nerve is lesioned, the left side of the soft palate will not elevate during a gag and the uvula will deviate to the right. In this case, the patient only feels the touch on the right side and only elevates the right side of the palate. Thus there is a lesion of both the left glossopharyngeal nerve and the left vagus nerve.

If the patient had a lesion of the left glossopharyngeal nerve only (choice B), there would have been no gag when the left side is touched but there would be a normal gag, without deviation of the uvula, when the right side was touched.

If the patient had a lesion of the left vagus nerve only (choice C), the patient would have deviation of the uvula to the right when a gag was elicited, but touching either side of the

pharynx would elicit a gag.

If the patient had a lesion of the right glossopharyngeal nerve and the right vagus nerve (choice D), touching the right side of the pharynx would not elicit a gag and touching the left side of the pharynx would elicit a gag with the uvula deviating to the left.

If the patient had a lesion of the right glossopharyngeal nerve only (choice E), there would be no gag when the right side is touched but there would be a normal gag, without deviation of the uvula, when the left side was touched.

If the patient had a lesion of the right vagus nerve only (choice F), the patient would have deviation of the uvula to the left when a gag was elicited and touching either side of the pharynx would elicit a gag.

To evaluate hypoglossal nerve function, a neurologist asks her patient to protrude his tongue. On doing so, his tongue deviates to the right side. This finding results from paralysis of which of the following muscles?

A. Left genioglossus

B. Left hyoglossus

C. Left palatoglossus

D. Right genioglossus

E. Right hyoglossus

F. Right palatoglossus

Explanation:

The correct answer is D. The genioglossus muscle is innervated by the hypoglossal nerve. The function of the genioglossus muscle is to pull the tongue forward (protrude) and toward the opposite side. When the right genioglossus muscle is paralyzed, the left genioglossus muscle pulls the tongue forward and to the right.

If the left genioglossus muscle were paralyzed (choice A), the tongue would deviate toward the left on protrusion because of the unopposed action of the right genioglossus muscle. The left genioglossus muscle is innervated by the left hypoglossal nerve.

The hyoglossus muscles (choices B and E) are innervated by the hypoglossal nerves. The function of these muscles is to retract the tongue. These muscles are not active during protrusion of the tongue.

The palatoglossus muscles (choices C and F) are innervated by the vagus nerves, rather than the hypoglossal nerves. Their function is to pull the tongue back (retract) and upward toward the palate.

A 75-year-old man with a 40-pack-year history of smoking and hypercholesterolemia has severe atherosclerosis. Occlusion of which of the following arteries would result in insufficient perfusion of the urinary bladder?

A. External iliac

B. Inferior epigastric

C. Internal iliac

D. Internal pudendal

E. Lateral sacral

Explanation:

The correct answer is C. The bladder is supplied by the vesicular branches of the internal iliac arteries. The internal iliacs arise from the common iliac artery. Note that this is a simple fact question (Which artery supplies the urinary bladder?) embedded in a clinical scenario.

The external iliac (choice A) also arises from the common iliac artery. It makes no contribution to the blood supply of the bladder.

The inferior epigastric (choice B) is a branch of the external iliac artery. It serves as a landmark in the inguinal region. Indirect inguinal hernias lie lateral to the inferior epigastric arteries, whereas direct inguinal hernias lie medial to these vessels. A good mnemonic is MD's don't LIe. (Medial-Direct, Lateral-Indirect).

The internal pudendal (choice D) is a branch of the anterior division of the internal iliac artery. It gives rise to the inferior rectal artery, perineal artery, artery of the bulb in men, urethral artery, deep artery of the penis or clitoris, and dorsal artery of the penis or clitoris.

The lateral sacral (choice E) is a branch of the posterior division of the internal iliac artery. It supplies sacral structures.

A patient's left hypoglossal nerve (CN XII) is injured during a carotid endarterectomy. Which of the following would most likely result from this injury?

A. Decreased gag reflex on the left

B. Decreased salivation from the left submandibular and sublingual salivary glands

C. Deviation of the tongue to the left on protrusion

D. Inability to elevate the pharynx on the left during swallowing

E. Inability to perceive sweet and salt taste sensation on the anterior part of the left side of the tongue

Explanation:

The correct answer is C. The hypoglossal nerve is a pure motor nerve (general somatic efferent) to the intrinsic muscles of the tongue. If the nerve is damaged, denervation atrophy of the affected side will permit the intact musculature of the opposite side to operate unopposed, thereby protruding the tongue to the side of the injury.

The gag reflex (choice A) is mediated by the glossopharyngeal nerve (CN IX; afferent limb) and the vagus nerve (CN X; efferent limb).

Choice B is incorrect because the preganglionic parasympathetic fibers that regulate these two salivary glands are carried by the chorda tympani (which joins with the lingual nerve) to the

submandibular ganglion. Postganglionic fibers are then distributed to these glands.

The muscles responsible for elevation of the pharynx (choice D) are innervated primarily by the vagus nerve (CN X).

Choice E is incorrect because taste fibers for the anterior two-thirds of the tongue are carried via the chorda tympani to the facial nerve (CN VII) and hence to the brainstem.

A patient develops an excruciatingly painful infection of the anterior half of the external ear canal. Which of the following nerves transmits this impulse?

A. Auricular branch of the vagus

B. Auriculotemporal nerve

C. Greater auricular nerve

D. Lesser occipital nerve

E. Vestibulocochlear nerve

Explanation:

The correct answer is B. The ear has a complex sensory nerve supply, which includes all of the nerves listed. A consequence of this complexity is that pain actually originating in other sites (teeth and sinuses are notorious) may be misinterpreted as ear pain or (less commonly) pain originating in the ear may be misinterpreted as arising from other sites. The anterior half of the external ear canal is supplied by the auriculotemporal nerve, which also supplies the facial surface of the upper part of the auricle.

The auricular branch of the vagus (choice A) supplies the posterior half of the external ear canal.

The greater auricular nerve (choice C) supplies both surfaces of the lower part of the auricle.

The lesser occipital nerve (choice D) supplies the cranial surface of the upper part of the auricle.

The vestibulocochlear nerve (choice E) supplies hearing and motion sense.

During preparation for a voiding cystourethrogram, a urologist inserting a catheter accidentally damages the wall of the membranous portion of the urethra in the deep perineal space. If contrast medium used to fill the bladder for the cystourethrogram were to enter the deep perineal space, it could come into contact with which of the following structures?

A. Bulbocavernosus muscle

B. Bulbourethral gland

C. Crus of the penis

D. Ischiocavernosus muscle

E. Seminal vesicle

Explanation:

The correct answer is B. The deep perineal space is the region of the middle layer of the urogenital diaphragm. This layer of the diaphragm contains two skeletal muscles, the sphincter urethrae muscle and the deep transverse perineal muscle. Also found in this space is the bulbourethral gland (Cowper's gland). The membranous portion of the urethra is the portion of the urethra that passes through the urogenital diaphragm.

The bulbocavernosus muscle (choice A) is the skeletal muscle that covers the bulb of the penis. The bulb of the penis is in the superficial perineal space, inferior to the urogenital diaphragm.

The crus of the penis (choice C) is the erectile body that is continuous with the corpus spongiosum of the penis. The crus of the penis is in the superficial perineal space, where it is attached to the inferior surface of the urogenital diaphragm and to the ischiopubic ramus of the pelvis.

The ischiocavernosus muscle (choice D) is the skeletal muscle that covers the crus of the penis. The ischiocavernosus muscle and the crus of the penis are found in the superficial perineal space.

The seminal vesicle (choice E) is in the pelvis, superior to both the pelvic diaphragm and the urogenital diaphragm. The seminal vesicle's duct joins the ductus deferens to form the ejaculatory duct, which enters the prostatic portion of the urethra.

A 55-year-old male mechanic suffers a stroke while trying to replace a flat tire on the road. He has a history of hypertension, but had not been taking his medications regularly. In addition, he is a heavy smoker, and drinks a six-pack of beer every weekend. On examination, he is conscious and has difficulty speaking clearly. A right upper motor neuron paralysis of the facial nerve is noted; the other cranial nerves are normal. He has a dense hemiplegia on the right side, with equal paralysis of the arm and leg. His lesion most likely involves the

A. convexity of the left frontal lobe

B. convexity of the right frontal lobe

C. corticospinal tract in the upper cervical spinal cord

D. left internal capsule

E. right internal capsule

Explanation:

The correct answer is D. This patient has sustained a hemorrhage of the left internal capsule secondary to uncontrolled hypertension. The internal capsule receives its blood supply from the lenticulostriate arteries, which are prone to rupture in uncontrolled hypertension. The anterior limb of the internal capsule conveys frontopontine fibers, the genu conducts corticobulbar fibers, and the posterior limb of the internal capsule conveys corticospinal fibers to the contralateral arm and leg. Hemorrhage of the left internal capsule results in right-sided dense hemiplegia in which paralysis of the arm and leg are of the same intensity.

The convexity of the frontal lobe (choices A and B) does not control the leg. This is done by the medial aspect of the cerebral hemisphere. Also, a hemorrhage involving the right frontal lobe (choice B) would affect the left side of the body. This patient has right-sided paralysis.

Lesions of the corticospinal tract in the upper cervical spinal cord (choice C) would result in

hemi- or quadriparesis/plegia. The cranial nerves would not be involved.

Hemorrhage involving the right internal capsule (choice E) would result in left-sided paralysis.

What is the most important source of noradrenergic innervation to the cerebral cortex?

A. Basal nucleus of Meynert

B. Caudate nucleus

C. Locus coeruleus

D. Raphe nucleus

E. Substantia nigra

F. Ventral tegmental area

Explanation:

The correct answer is C. The locus coeruleus is a dense collection of neuromelanin-containing cells in the rostral pons, near the lateral edge of the floor of the fourth ventricle. The fact that it appears blue-black in unstained brain tissue gave rise to its name, which means "blue spot" in Latin. These cells, which contain norepinephrine, provide the majority of noradrenergic innervation to the forebrain, including the cerebral cortex.

The basal nucleus of Meynert (choice A), a part of the substantia innominata, is a major collection of forebrain cholinergic neurons. These neurons (together with neurons in septal nuclei) innervate the neocortex, hippocampal formation, and the amygdala. The basal nucleus is one of the structures that degenerates in Alzheimer's disease.

The caudate nucleus (choice B) is part of the basal ganglia, located immediately lateral to the lateral ventricles. There are at least two important cell types in the caudate. GABAergic projection neurons (the majority) innervate the globus pallidus and substantia nigra pars reticulata. The GABAergic neurons degenerate in Huntington's disease, which leads to enlarged lateral ventricles, clearly visible on MRI. The caudate also contains cholinergic interneurons, which provide most of the acetylcholine to the striatum (caudate and putamen). The balance of striatal acetylcholine and dopamine is important for the treatment of patients with extrapyramidal symptoms, such as Parkinson's disease or parkinsonism accompanying therapy with antipsychotic medications.

The raphe nuclei (choice D) are located in the midline at most levels of the brainstem. They contain serotonergic cell bodies that innervate virtually every part of the central nervous system.

The substantia nigra (choice E) is located in the midbrain, and consists of the substantia nigra pars compacta and the substantia nigra pars reticulata. The substantia nigra pars compacta contains the nigrostriatal neurons that are the source of striatal dopamine. This cell group degenerates in Parkinson's disease or in response to neurotoxic agents such as MPTP. The substantia nigra pars reticulata consists predominately of GABAergic neurons that innervate the thalamus.

The ventral tegmental area (choice F) is located in the midbrain and is an important source of dopamine for the limbic and cortical areas. These cells are called mesolimbic and mesocortical neurons. Overactivity of this cell group is a popular theory of the etiology of schizophrenia,

and is the basis for the administration of antipsychotic agents (dopamine receptor antagonists).

A resident physician is performing a pelvic examination on a young woman. The fingers of one of her hands is in the patient's vagina and is palpating the cervix. The other hand is pressing on the abdomen. With the palm of this hand, the physician feels a bony structure in the lower midline. This structure is most likely the

A. coccyx

B. ilium

C. ischium

D. pubis

E. sacrum

Explanation:

The correct answer is D. The resident is feeling the two pubic bones, which are joined at the midline by the symphysis pubis. Experienced obstetrician/gynecologists can often perceive the softening of the symphysis pubis that occurs during late pregnancy as a "springiness" of the pubic bones during palpation.

The coccyx (choice A) is the caudal terminus of the vertebral column, generally formed by the fusion of four rudimentary vertebral bodies. It is also called the tailbone.

The ischium (choice C) is the portion of the pelvis on which a person sits.

The ilium (choice B) is one of the two "wings" that form the lateral sides of the pelvic cavity and support the abdominal contents.

The sacrum (choice E) is the triangular bone situated just beneath the lumbar vertebrae.

A 50 -year-old electrician reports pain in his left upper extremity and tingling and numbness in his 4th and 5th digits of his left hand. There is mild swelling of the left hand. The man reports most of his pain and numbness occurs when he is doing electrical work with his arms overhead. X-ray reveals the presence of a cervical rib. Which of the following structures is most likely being compressed?

A. Axillary artery

B. Brachial artery

C. Brachiocephalic artery

D. Subclavian artery

E. Subscapular artery

Explanation:

The correct answer is D. The subclavian artery passes laterally over the upper surface of the first rib and lies posterior to the scalenus anterior. In the case of thoracic outlet syndrome, this artery is usually compressed between the scalenus anterior and a cervical rib. Thoracic

outlet syndrome is a broad term for a group of disorders in which there is compression of certain neurovascular bundles. The presence of a cervical rib adds to the compression, and repetitive motion and poor posture are other predisposing factors. When the neurovascular bundle is entrapped, the patient presents with neurological and/or circulatory changes in the upper extremity on the involved side.

The axillary artery (choice A) is the continuation of the subclavian artery. This artery begins at the outer border of the first rib and continues through the axilla to the lower border of the teres major.

The brachial artery (choice B) is the continuation of the axillary artery in the upper extremity and can not be compressed by a cervical rib.

The brachiocephalic artery (choice C) arises from the arch of the aorta. At the level of the right sternoclavicular joint, it separates into the right common carotid artery and the right subclavian artery.

The subscapular artery (choice E) is the largest branch of the axillary artery. It supplies muscles on the lateral thoracic wall and scapular muscles.

A 49-year-old man presents with complaints of pain and cramps in his calf muscles when he walks for long distances. The pain is relieved by resting. The physician suspects arterial insufficiency to the lower limbs and wishes to evaluate the arterial flow by palpation of the dorsalis pedis pulses. In which of the following locations may this pulse be palpated?

A. On the dorsum of the foot, medial to the tibialis anterior tendon

B. On the dorsum of the foot, between the tibialis anterior tendon and the extensor hallucis longus tendon

C. On the dorsum of the foot, between the extensor hallucis longus tendon and the extensor digitorum longus tendon

D. On the dorsum of the foot, lateral to the extensor digitorum longus tendon

E. Posterior to the medial malleolus of the ankle

Explanation:

The correct answer is C. The dorsalis pedis artery is the continuation of the anterior tibial artery after the artery crosses the ankle to reach the dorsum of the foot. Its pulse is the most distal palpable pulse in the lower limb and therefore is useful for evaluating the arterial supply to the limb. On the dorsum of the foot, the pulse may be felt as the artery passes over the navicular bone between the extensor hallucis longus tendon and the extensor digitorum longus tendon.

The other locations on the dorsum of the foot (choices A, B, and D) are not sites where this artery may be palpated.

Posterior to the medial malleolus (choice E) is the site where the posterior tibial artery passes into the foot. The pulse of this artery may be felt in this location.

An individual has an eye that is persistently directed toward his nose. A lesion of which of the following nerves could produce this finding?

A. CN III

B. CN IV

C. CN V

D. CN VI

E. CN VII

Explanation:

The correct answer is D. Cranial nerve VI is the abducens nerve, which supplies the abductor of the eye, the lateral rectus. A paralysis of the lateral rectus leads to unopposed adduction, causing the eye to point toward the nose.

Cranial nerve III (choice A) is the oculomotor nerve, which supplies all of the muscles of the eye except the superior oblique and lateral rectus. Paralysis of III would impair abduction, not adduction, of the eye. The eye would tend to rotate downward and outward.

Cranial nerve IV (choice B) is the trochlear nerve, which supplies the superior oblique muscle. This muscle serves to depress and abduct (down and out) the eyeball. Paralysis of IV tends to produce double vision, but does not cause an obvious deficit in conjugate gaze without careful testing.

Cranial nerve V (choice C) is the trigeminal nerve, which is a mixed sensory and motor nerve that supplies the face. It provides sensory innervation to the face and innervates the muscles of mastication. It does not innervate the eye muscles.

Cranial nerve VII (choice E) is the facial nerve, which innervates the muscles of facial expression, but not the muscles of the orbit. CN VII is additionally involved in salivation, lacrimation, taste, and general sensation from the external ear.

While lying supine in bed eating, a child aspirates a peanut. Which of the following bronchopulmonary segments would this foreign object most likely enter?

A. Apical segment of the left upper lobe

B. Apical segment of the right upper lobe

C. Medial segment of the right middle lobe

D. Posterior basal segment of the left lower lobe

E. Superior segment of the right lower lobe

Explanation:

The correct answer is E. Because the right main bronchus is wider and more vertical than the left, foreign objects are more likely to be aspirated into the right main bronchus. The superior segmental bronchus of the lower lobar bronchus is the only segmental bronchus that exits from the posterior wall of the lobar bronchi. Therefore, if a patient is supine at the time of aspiration, the object is most likely to enter the superior segmental bronchus of the lower lobe.

None of the segmental bronchi of the left lung (choices A and D) are likely to receive the object because the object is less likely to enter the left main bronchus.

The apical segment of the right upper lobe (choice B) is not likely to receive the foreign object because of the sharp angle that the upper lobar bronchus makes with the right main bronchus and the sharp angle that the apical segmental bronchus makes with the lobar bronchus.

The medial segmental bronchus of the right middle lobe (choice C) arises from the anterior wall of the right middle lobar bronchus. Therefore, when the patient is supine, the effect of gravity will tend to prevent the object from entering this segmental bronchus.

Which of the following renal structures is most medially located?

A. Major calyx

B. Minor calyx

C. Renal cortex

D. Renal pelvis

E. Renal pyramid

Explanation:

The correct answer is D. This is a relatively simple question that requires you to visualize the relationship among the key parts of the kidney and to identify the one that lies most medially. If you think about it for a second, since the kidneys ultimately drain into the ureter at their medial poles, you are looking for the structure that is closest to the ureter. The correct answer is the renal pelvis. The renal pelvis is the dilated upper portion of the ureter that receives the major calyces.

In terms of the other answer choices, the order from most lateral to most medial is: renal cortex (choice C), renal pyramid (choice E), minor calyx (choice B), major calyx (choice A), and then the renal pelvis (choice D).

A 51-year-old supermarket cashier begins to have difficulty working, sometimes ringing up the wrong amount because her right hand feels "weak." She also notes that her right hand sometimes feels numb after working for long periods of time. Physical examination reveals loss of sensation on the palmar aspect of her thumb and first two fingers, as well as atrophy of the thenar eminence on her right hand. The nerve most likely injured in this patient also innervates which of the following muscles?

A. Adductor pollicis

B. Extensor digitorum

C. Extensor pollicis longus

D. Flexor carpi ulnaris

E. Flexor digitorum superficialis

Explanation:

The correct answer is E. The nerve is the median nerve, which can be damaged by repetitive minor trauma (e.g., typing or using a cash register) as it passes under the flexor retinaculum. Inflammation causes tissue swelling, producing "carpal tunnel syndrome," and entrapping the

nerve. The median nerve supplies sensation to the anterior forearm and the palmar aspect of the thumb and adjacent 2-and-one-half fingers. It supplies motor function to all of the anterior forearm muscles (including the flexor digitorum superficialis) except the flexor carpi ulnaris (supplied by the ulnar nerve) and one half of the flexor digitorum profundus (supplied by the ulnar nerve). The median nerve also supplies the thenar muscles and the lateral lumbricals.

The adductor pollicis (choice A) is supplied by the ulnar nerve.

The extensors digitorum (choice B) are supplied by the radial nerve.

The extensor pollicis longus (choice C) is supplied by the radial nerve.

The flexor carpi ulnaris (choice D) is supplied by the ulnar nerve.

A surgeon wishes to perform a splenectomy on a patient who has been in an automobile accident. Before removing the spleen, the splenic artery and splenic vein are ligated. Within which of the following peritoneal structures are the splenic artery and vein found?

A. Gastrocolic ligament

B. Gastrosplenic ligament

C. Lesser omentum

D. Splenorenal ligament

Explanation:

The correct answer is D. The splenorenal ligament is the portion of the dorsal mesentery between the posterior abdominal wall and the spleen. This mesentery transmits the splenic artery and vein from their retroperitoneal position in the proximal portion of their course to the peritoneal spleen.

The gastrocolic ligament (choice A) is the portion of the greater omentum between the greater curvature of the stomach and the transverse colon. This portion of mesentery is not related to the spleen.

The gastrosplenic ligament (choice B) is the portion of the dorsal mesogastrium between the greater curvature of the stomach and the spleen. There are no splenic vessels in this mesentery.

The lesser omentum (choice C) is derived from the ventral mesentery. It is the mesentery between the lesser curvature of the stomach and the liver and between the first portion of the duodenum and the liver. It is not related to the spleen.

A patient has a herniated intervertebral disc impinging on the right C5 nerve roots. Which of the following movements would most likely be affected?

A. Extension of the fingers

B. Extension of the shoulder

C. Flexion of the elbow

D. Flexion of the wrist

E. Pronation of the elbow

Explanation:

The correct answer is C. C5 helps mediate flexion, abduction, and lateral rotation of the shoulder, and flexion of the elbow. Both C5 and C6 mediate extension of the elbow.

Extension of the fingers (choice A) is mediated by C7 and 8.

Extension of the shoulder (choice B) is mediated by C7 and 8.

Flexion of the wrist (choice D) is mediated by C6 and 7.

Pronation of the elbow (choice E) is mediated by C7 and 8.

The inferior mesenteric artery arises from the abdominal aorta immediately posterior to which of the following organs?

A. First part of the duodenum

B. Head of the pancreas

C. Neck of the pancreas

D. Second part of the duodenum

E. Third part of the duodenum

Explanation:

The correct answer is E. The inferior mesenteric artery arises from the anterior surface of the aorta at the level of the third lumbar vertebra. The third part of the duodenum crosses the midline at the level of the third lumbar vertebra and passes anterior to the aorta at the origin of the inferior mesenteric artery.

The first part of the duodenum (choice A) lies horizontally to the right of the midline at the level of the first lumbar vertebra.

The head of the pancreas (choice B) is to the right of the midline and extends from the level of the first lumbar vertebra to the third lumbar vertebra. It lies within the concavity of the duodenum.

The neck of the pancreas (choice C) lies in the midline at the level of the first lumbar vertebra. It lies on the anterior surface of the aorta at the origin of the superior mesenteric artery.

The second part of the duodenum (choice D) lies vertically to the right of the midline and extends from the level of the first lumbar vertebra to the level of the third lumbar vertebra.

A hunter got his foot caught in a bear trap. The emergency room physician evaluating the patient notes that a tendon that inserts onto the plantar surface of the base of the distal 3rd phalanx has been severed. The patient is no longer able to plantar flex that toe. This tendon arises from a muscle that originates from which of the following structures?

A. Distal 1/3 of the anterior surface of the fibula

B. Distal 2/3 of the lateral surface of the fibula

C. Head and proximal 2/3 of the lateral surface of the fibula

D. Middle 1/2 of the anterior surface of the fibula

E. Posterior surface of the middle 3/5 of tibia

Explanation:

The correct answer is E. The muscle is the flexor digitorum longus. This muscle arises from the posterior surface of the middle 3/5 of the tibia, passes under the medial aspect of the ankle, and forms four tendons in the sole of the foot that insert into the bases of the distal phalanges of the 2nd-5th toes. This muscle acts to flex the toes and foot, and to invert the foot at the ankle.

Choice A describes the origin of peroneus tertius. This muscle acts to extend the foot at the ankle joint, and evert the foot at the subtalar and transverse tarsal joints.

Choice B describes the origin of peroneus brevis. This muscle acts to plantar flex the foot at the ankle joint, and evert the foot at the subtalar and transverse tarsal joints.

Choice C describes the origin of peroneus longus. This muscle acts to plantar flex the foot at the ankle joint, and evert the foot at the subtalar and transverse tarsal joints.

Choice D describes the origin of extensor hallucis longus. This muscle acts to extend the great toe and extend the foot at the ankle.

One week following a sexual encounter at a ski resort in Colorado, a young woman develops a painful, swollen knee joint. The emergency room doctor suspects gonococcal arthritis and wants to confirm this by sending joint fluid for bacterial culture. He uses the standard suprapatellar approach and passes a needle from the lateral aspect of the thigh into the region immediately proximal to the patella. Through which of the following muscles does the needle pass?

A. Adductor magnus

B. Gracilis

C. Iliacus

D. Sartorius

E. Vastus lateralis

Explanation:

The correct answer is E. This route passes through the vastus lateralis to penetrate the knee joint via the suprapatellar bursa, allowing aspiration of joint fluid for culture. The vastus lateralis, together with the vastus medialis, vastus intermedius and rectus femoris, form the quadriceps muscle.

The adductor magnus (choice A) is on the inner and anterior aspect of the upper thigh.

The gracilis (choice B) is on the inner aspect of the thigh.

The iliacus (choice C) is on the lateral, proximal aspect of the thigh.

The sartorius (choice D) passes diagonally from the lateral hip to the medial knee.

A 23-year-old male suffers a whiplash injury during an automobile accident. There is a posterolateral herniation of the nucleus pulposus of the intervertebral disk between vertebrae C4 and C5. What neural structure is most likely to be injured?

A. Anterior ramus C5

B. Posterior ramus C4

C. Spinal cord

D. Spinal nerve C4

E. Spinal nerve C5

Explanation:

The correct answer is E. A posterolateral herniation of the nucleus pulposus is the most common type of herniation. This herniation results in the nucleus pulposus occupying space within the intervertebral foramen. The spinal nerve in the intervertebral foramen between vertebrae C4 and C5 is the C5 spinal nerve.

The anterior and posterior rami (choices A and B) are found lateral to the intervertebral foramina and are not compressed by a herniated nucleus pulposus.

The spinal cord (choice C) is within the vertebral canal. A posterior herniation of a nucleus pulposus (less common) may compress the spinal cord.

Spinal nerve C4 (choice D) is found in the intervertebral foramen between vertebrae C3 and C4 and would not be compressed by this herniation.

An inflammatory process in the temporal bone has resulted in a swelling of the facial nerve within the facial canal. Which muscle may be paralyzed as a result of this compression?

A. Anterior belly of the digastric

B. Geniohyoid

C. Stapedius

D. Stylopharyngeus

E. Masseter

Explanation:

The correct answer is C. The stapedius muscle is innervated by the facial nerve. This muscle is located in the middle ear and attaches to the neck of the stapes. Contraction of the stapedius reduces the amplitude of oscillation of the stapes and thus reduces the perceived loudness of a sound. Paralysis of this muscle may result in hyperacusis.

The anterior belly of the digastric muscle (choice A) is a muscle in the floor of the mouth that is innervated by the mandibular division of the trigeminal nerve.

The geniohyoid muscle (choice B) is one of the suprahyoid muscles in the neck. This muscle is innervated by C1 spinal nerve fibers that travel for a short distance with the hypoglossal nerve.

The stylopharyngeus muscle (choice D) is one of the longitudinal muscles of the pharynx that acts to elevate the pharynx. It is innervated by the glossopharyngeal nerve.

The masseter muscle (choice E) is one of the muscles of mastication. All of the muscles of mastication are innervated by the mandibular division of the trigeminal nerve.

A 22-year-old woman presents to her physician with amenorrhea, weight loss, anxiety, tremor, heat intolerance and palpitations. Laboratory examination is consistent with hyperthyroidism, and the physician prescribes propylthiouracil. The patient's response to propylthiouracil is disappointing, and the symptoms recur, then worsen. Subtotal thyroidectomy is successfully performed, but following the surgery, the woman is extremely hoarse, and can barely speak above a whisper. This hoarseness is most probably related to damage to a branch which of the following cranial nerves?

A. Facial

B. Glossopharyngeal

C. Hypoglossal

D. Trigeminal

E. Vagus

Explanation:

The correct answer is E. The recurrent laryngeal nerves are branches of the vagus (CN X), and supply all intrinsic muscles of the larynx except the cricothyroid. The right recurrent laryngeal nerve recurs around the right subclavian artery. The left recurrent laryngeal nerve recurs in the thorax around the arch of the aorta and ligamentum arteriosum. Both nerves ascend to the larynx by passing between the trachea and esophagus, in close proximity to the thyroid gland. The recurrent laryngeal nerves are therefore particularly vulnerable during thyroid surgery, and damage may cause extreme hoarseness.

The facial nerve (choice A) innervates the muscles of facial expression, the stapedius muscle, and the lacrimal, submandibular and sublingual glands. It also mediates taste sensation from the anterior two-thirds of the tongue.

The glossopharyngeal nerve (choice B) innervates the stylopharyngeus muscle and the parotid gland. Visceral afferents supply the carotid sinus baroreceptors and carotid body chemoreceptors, and mediate taste from the posterior one-third of the tongue. Somatosensory fibers supply pain, temperature, and touch information from the posterior one-third of the tongue, upper pharynx, middle ear, and eustachian tube.

The hypoglossal nerve (choice C) innervates the intrinsic muscles of the tongue, the genioglossus, hypoglossus, and styloglossus muscles.

The trigeminal nerve (choice D) receives sensory information from the face and also innervates the muscles of mastication.

A patient comes to the emergency room after driving a knife into her palm while trying to slice a stale bagel. On follow-up examination several weeks later, the thenar eminence is observed to be

flattened. The nerve in question enters the forearm at which of the following sites?

A. Between the flexor carpi ulnaris and the flexor digitorum profundus

B. Behind the lateral epicondyle and between the two heads of the supinator

C. Behind the medial epicondyle and between the two heads of the flexor carpi ulnaris

D. Between the palmaris longus and flexor carpi radialis tendons

E. Between the two heads of the pronator teres muscle

Explanation:

The correct answer is E. The nerve in question is the median nerve, which enters the forearm between the two heads of the pronator teres muscle. The median nerve then traverses the forearm deeply in the arm between the flexor digitorum superficialis and the flexor digitorum profundum. At the wrist, the nerve rises very superficially and passes under the retinaculum. Immediately after the retinaculum, it gives rise to a branch to the thenar muscles. Either the median nerve or this branch can easily be injured by a knife wound to the palm, and will cause denervation atrophy of the thenar muscles at the root of the thumb.

Choice A describes the location of the ulnar nerve at the wrist.

Choice B describes the location of the radial nerve and its posterior interosseous branch near the elbow.

Choice C describes the location of the ulnar nerve at the elbow.

Choice D describes the location of the median nerve at the wrist.

Which of the following prevents hyperextension of the knee?

A. Anterior cruciate ligament

B. Lateral semilunar cartilage

C. Medial semilunar cartilage

D. Posterior cruciate ligament

E. Transverse ligament

Explanation:

The correct answer is A. The anterior cruciate ligament passes from its anterior attachment on the anterior aspect of the intercondylar eminence upward and laterally and posteriorly to attach to the medial side of the lateral condyle of the femur. Thus, in normal movement, as the condyles of the femur rotate backward on the head of the tibia, the anterior cruciate ligament is put under stretch and comes to arrest rotation at full extension.

The lateral (choice B) and medial (choice C) semilunar cartilages (the menisci) function to aid in rotation of the condyles; they do so by moving on the tibia. The medial cartilage is attached to the tibial collateral ligament and the lateral one has the meniscofemoral ligament and the popliteus muscle attached to it. During rotation of the condyles of the femur, these various attachments pull on the menisci, causing them to move in concert. Being thicker at

their peripheral margins and by conforming to the tibial surface of the associated condyles, these two cartilages also aid in joint stability.

The posterior cruciate ligament (choice D), which extends between the dorsal aspect of the posterior intercondylar fossa of the tibia and the lateral surface of the medial condyle, comes under full tension during flexion of the knee joint. Actually, both the anterior and posterior cruciate ligaments, in all joint positions, are under some degree of tension. This provides stability to the full range of movements of the knee.

The transverse ligament (transverse genicular ligament; choice E) is a fibrous band of connective tissue that connects the anterior end of the lateral meniscus to the anterior end of the medial meniscus of the knee. By the nature of its attachments, it would not contribute to the control of knee extension, and, in fact, this ligament is often absent.

A thyroid mass usually moves with swallowing because the thyroid gland is enclosed by which of the following fascia?

A. Carotid sheath

B. Investing layer of the deep cervical fascia

C. Pretracheal fascia

D. Prevertebral fascia

E. Superficial fascia

Explanation:

The correct answer is C. The pretracheal layer of the cervical fascia runs from the investing layers in both sides of the lateral neck and splits to enclose the thyroid gland. Superiorly, it attaches to the laryngeal cartilages; inferiorly, it fuses with the pericardium. As a result of these connections, the thyroid gland moves with laryngeal movements.

The carotid sheath (choice A) contains the vagus nerve, internal jugular vein, carotid artery, and lymph nodes.

The investing layer of the deep cervical fascia (choice B) splits to enclose the trapezius and sternocleidomastoid muscles.

The prevertebral fascia (choice D) covers muscles arising from the vertebrae.

The superficial fascia (choice E) is immediately deep to the platysma muscle.

A 61-year-old Cambodian immigrant is diagnosed with spinal tuberculosis. The man develops a flocculent, red, tender bulge on one flank, with a similar bulge in the groin on the same side. This presentation is likely due to spread of infection along the fascia of a muscle with which of the following actions at the hip?

A. Abduction

B. Adduction

C. Extension

D. Flexion

E. Internal rotation

Explanation:

The correct answer is D. The muscle involved is the psoas major. The abscess in the groin is called a "psoas abscess," because it occurs after a spinal infection (classically tuberculosis) spreads along the psoas sheath. The principal action of the psoas muscle is to flex the thigh at the hip. It also has minimal action in external rotation of the hip.

Abductors (choice A) of the hip include the gluteus medius and gluteus maximus.

Adductors (choice B) of the hip include the adductors longus, brevis, and magnus.

Extensors (choice C) of the hip include gluteus maximus.

Internal (medial) rotators (choice E) of the hip include gluteus minimus, pectineus, and gracilis.

A 68-year-old hypertensive man suffers a small stroke and is hospitalized. After discharge, he is seen by a neurologist. On physical examination, the man is unable to touch the tip of his tongue to the roof of his mouth. Dysfunction of which of the following muscles would be most likely to produce this result?

A. Buccinator

B. Geniohyoid

C. Palatoglossus

D. Palatopharyngeus

E. Tensor palati

Explanation:

The correct answer is C. Elevation of the tongue is carried out by the styloglossus (innervated by the hypoglossal nerve, CN XII) and the palatoglossus (innervated by the pharyngeal plexus).

The buccinator (choice A) functions in storing, filling, and emptying the vestibule.

The geniohyoid (choice B) moves the hyoid anteriorly to open the pharynx.

The palatopharyngeus (choice D) produces a "stripping wave" on the posterior pharyngeal wall.

The tensor palati (choice E) tenses the soft palate.

During an abdominal surgical procedure, the surgeon wishes to locate the ureter in order to ensure that it is not injured. The ureter may be found immediately anterior to the origin of the

A. common iliac artery

B. external iliac artery

C. internal iliac artery

D. gonadal artery

E. renal artery

Explanation:

The correct answer is B. The ureter leaves the renal pelvis and lies on the posterior abdominal wall as it descends to the pelvis. It crosses the pelvic brim at the level of the bifurcation of the common iliac artery. At this point it crosses anterior to the origin of the external iliac artery to enter the pelvis.

The origin of the common iliac artery (choice A) is at the bifurcation of the abdominal aorta, which occurs at the level of the fourth lumbar vertebra in the midline of the abdomen. Both ureters are lateral to the aortic bifurcation.

The origin of the internal iliac artery (choice C) is at the bifurcation of the common iliac artery, which occurs at about the level of the first sacral vertebra. The ureter and the internal iliac artery both enter the pelvis with the ureter on the lateral side of the artery.

The origin of the gonadal artery (choice D) (either the testicular artery or the ovarian artery) is from the abdominal aorta at a variable level, usually between the renal artery and the inferior mesenteric artery. The ureters are lateral to the origin of this artery.

The origin of the renal artery (choice E) is from the abdominal aorta at about the level of the second lumbar vertebra. The renal arteries pass laterally to enter the renal pelvis. At this site, the ureter is posterior to the artery.

A 29-year-old man presents with a chief complaint of difficulty with fine motor control in his hand. Physical examination reveals a deficit in his ability to abduct and adduct his digits, and inability to oppose his thumb on his right hand. The patient reports that a few weeks ago he had been on a ladder trimming the branches of a tree outside his home. The ladder slid out from under him, and as he was falling he reached out and grabbed onto a limb of the tree to break his fall. Which of the following neural structures was most likely injured?

A. Lower trunk of the brachial plexus

B. Median nerve

C. Musculocutaneous nerve

D. Upper trunk of the brachial plexus

E. Ulnar nerve

Explanation:

The correct answer is A. The lower trunk of the brachial plexus contains nerve fibers from the eighth cervical and first thoracic spinal nerves. These nerve fibers innervate the intrinsic muscles of the hand, including the interosseous muscles, responsible for abduction and adduction of the digits, and the opponens muscle, responsible for opposition of the thumb. The lower trunk ascends from the lower neck and upper thorax to reach the axilla. Upward traction on the upper limb, such as that which occurred in grabbing onto the tree limb to break the fall, may stretch the lower trunk and injure these nerve fibers.

The median nerve (choice B) innervates many muscles of the anterior compartment of the forearm and some muscles in the hand, including the opponens muscle. The median nerve, however, does

not innervate the interosseous muscles, responsible for abduction and adduction of the digits.

The musculocutaneous nerve (choice C) innervates the muscle of the anterior compartment of the arm. It does not innervate any muscles in the hand.

The upper trunk of the brachial plexus (choice D) contains nerve fibers from the fifth and sixth cervical spinal nerves. The nerve fibers innervate muscles in the proximal part of the upper limb, including muscles around the shoulder and axilla. No muscles in the hand are innervated by these nerve fibers.

The ulnar nerve (choice E) innervates many muscles in the hand, including the interosseous muscles, which are responsible for abduction and adduction of the digits. However, it does not innervate the opponens muscle, which is responsible for opposition of the thumb.

A patient loses the ability to flex his forefinger. The nerve that supplies the muscles that cause this action is formed from which of the following cord(s) of the brachial plexus?

A. Lateral only

B. Medial and lateral

C. Medial only

D. Medial and posterior

E. Posterior only

Explanation:

The correct answer is B. The muscles involved are the flexor digitorum superficialis and the flexor digitorum profundus. The flexor digitorum superficialis is completely supplied by the median nerve. The flexor digitorum profundus is supplied by both the ulnar (little finger side) and median (thumb side) nerves. Flexion of the forefinger is consequently dependent on the median nerve, which is formed by part of both the medial and lateral cords of the brachial plexus.

The lateral cord (choice A) alone supplies the musculocutaneous nerve.

The medial cord alone (choice C) supplies the ulnar nerve.

No nerve is supplied by both the medial and posterior cords (choice D).

The posterior cord alone (choice E) supplies the radial nerve.

A patient arrives at the emergency department with a knife blade embedded in his gluteal region. Radiographic examination reveals that the tip of the knife is against the upper border of the greater sciatic foramen. Which of the following nerves is most likely to have been injured?

A. Inferior gluteal

B. Obturator

C. Pudendal

D. Sciatic

E. Superior gluteal

Explanation:

The correct answer is E. Most of the greater sciatic foramen is occupied by the piriformis muscle. The superior gluteal nerve, artery, and vein exit through the greater sciatic foramen above the piriformis and lie against the upper border of the foramen. This nerve innervates the gluteus medius, gluteus minimus, and tensor fasciae latae muscles.

The inferior gluteal nerve (choice A) exits through the greater sciatic foramen below the piriformis muscle and lies against the inferior border of the foramen. This nerve innervates the gluteus maximus muscle.

The obturator nerve (choice B) exits through the obturator canal, an opening in the obturator membrane. This nerve innervates the muscles of the medial compartment of the thigh, the adductor longus, adductor brevis, part of the adductor magnus and the gracilis, and part of the pectineus muscle.

The pudendal nerve (choice C) exits through the greater sciatic foramen below the piriformis and lies against the lower border of the foramen. After entering the gluteal region briefly, the nerve passes through the lesser sciatic foramen to enter the perineum. It provides sensory and motor innervation to structures in the perineum.

The sciatic nerve (choice D) exits through the greater sciatic foramen below the piriformis muscle. This nerve is composed of the tibial nerve and the common peroneal nerve; it innervates muscles in the posterior compartment of the thigh and all of the muscles in the leg and foot.

A resident physician is demonstrating the correct technique for inserting a subclavian central venous line. He has a medical student palpate the clavicle, then the chest wall below it. The first bony structure that can be palpated below the inferior margin of the medial portion of the clavicle is the

A. acromion

B. atlas

C. first rib

D. manubrium

E. second rib

Explanation:

The correct answer is E. The palpable space immediately inferior to the clavicle is the first intercostal space, and the bone below it is the second rib.

The acromion (choice A) is the lateral extension of the scapular spine.

The atlas (choice B) is the first cervical vertebra, articulating with the occipital bone above and the axis below.

The first rib (choice C) is hidden under the clavicle.

The manubrium (choice D) is the most superior portion of the sternum.

A 54-year-old male has developed cirrhosis, with obstruction of the portal circulation within the liver. Portal blood could still be conveyed to the caval system via which of the following?

A. Azygos and hemiazygos veins

B. Gonadal veins

C. Internal iliac veins

D. Splenic vein

E. Vesical venous plexus

Explanation:

The correct answer is A. The esophageal venous plexus, which drains into the azygos and hemiazygos veins within the thorax, has anastomoses with branches of the left gastric vein. Thus, following blockage of the portal vein, portal blood may enter the superior vena cava via the azygos system. Other important portacaval connections include: the superior rectal vein with the middle and inferior rectal veins; paraumbilical veins with epigastric veins (engorgement of these vessels results in caput medusae); and the colic and splenic veins with renal veins and veins of the posterior body wall.

The gonadal veins (choice B) exclusively drain the gonads (although, in the female, the ovarian vein communicates with the uterovaginal plexus). These vessels have no anastomoses with portal vessels.

The internal iliac veins (choice C), which drain most of the pelvis and much of the inferior extremities, have no demonstrated portal anastomoses.

The splenic vein (choice D) is incorrect because it is itself a component of the portal venous system.

The vesical venous plexus (choice E), which is situated well within the pelvis and drains the bladder and the prostate (or uterus and vagina), has no association with portal vessels.

A 46-year-old man sustains a spider bite on his upper eyelid, and an infection develops. The physician is very concerned about spread of the infection to the dural venous sinuses of the brain via emissary veins. With which of the following dural venous sinuses does the superior ophthalmic vein directly communicate?

A. Cavernous sinus

B. Occipital sinus

C. Sigmoid sinus

D. Superior petrosal sinus

E. Straight sinus

Explanation:

The correct answer is A. The anterior continuation of the cavernous sinus, the superior ophthalmic vein, passes through the superior orbital fissure to enter the orbit. Veins of the

face communicate with the superior ophthalmic vein. Because of the absence of valves in emissary veins, venous flow may occur in either direction. Cutaneous infections may be carried into the cavernous sinus and result in a cavernous sinus infection which may lead to an infected cavernous sinus thrombosis. The cavernous sinus is lateral to the pituitary gland and contains portions of cranial nerves III, IV, VI, V2 and VI, and the internal carotid artery.

The occipital sinus (choice B) is at the base of the falx cerebelli in the posterior cranial fossa. It drains into the confluence of sinuses.

The sigmoid sinus (choice C) is the anterior continuation of the transverse sinus in the middle cranial fossa. The sigmoid sinus passes through the jugular foramen and drains into the internal jugular vein.

The superior petrosal sinus (choice D) is at the apex of the petrous portion of the temporal bone and is a posterior continuation of the cavernous sinus. The superior petrosal sinus connects the cavernous sinus with the sigmoid sinus.

The straight sinus (choice E) is at the intersection of the falx cerebri and the falx cerebelli in the posterior cranial fossa. The straight sinus connects the inferior sagittal sinus with the confluence of sinuses.

A 54-year-old man is evaluated by a neurologist because of a gait disorder. When the physician passively moves the patient's right great toe upward or downward, the patient cannot accurately report the direction of motion, although his perception of light touch and painful stimuli is unimpaired. This finding can best be explained by a lesion of which of the following structures?

A. Right fasciculus cuneatus

B. Right fasciculus gracilis

C. Right lateral lemniscus

D. Right medial lemniscus

E. Right ventroposterolateral nucleus of the thalamus

F. Right ventroposteromedial nucleus of the thalamus

Explanation:

The correct answer is B. The patient's inability to detect the position of his toe reflects a lack of conscious proprioception for this part of his body. Conscious proprioception, discriminative touch, and vibration sense are all carried by the dorsal column/medial lemniscus system. The fact that he can still perceive light touch and painful stimuli indicates that his anterolateral system is unimpaired. In the dorsal column/medial lemniscus system, the primary neuron's cell body is located in the dorsal root ganglia and sends its projection to the cord through the dorsal roots. The fibers do not synapse in the cord, but rather ascend the cord in the dorsal columns. Fibers carrying information from the legs ascend in the fasciculus gracilis; those receiving input from the arms project in the fasciculus cuneatus. Both ascend to the caudal medulla, where they terminate in the nucleus gracilis and nucleus cuneatus, respectively. The secondary neurons originating from these nuclei cross as the internal arcuate fibers, ascend as the medial lemniscus, then synapse in the ventroposterolateral (VPL) nucleus of the thalamus. Tertiary neurons from the VPL project to the ipsilateral somatosensory cortex. Therefore, a lack of conscious proprioception from the right toe could result from lesions to the right fasciculus gracilis, the right nucleus gracilis, the left medial lemniscus, the left VPL, or left somatosensory cortex.

The right fasciculus cuneatus (choice A) carries discriminative touch, proprioception, and vibration information from the upper extremities.

The right lateral lemniscus (choice C), part of the auditory system, receives input from the contralateral cochlear nuclei and from the superior olivary nuclei, and projects to the inferior colliculus.

The right medial lemniscus (choice D) carries discriminative touch, proprioception, and vibration information from the left side of the body.

The right ventroposterolateral (VPL) nucleus of the thalamus (choice E) receives all sensory information (including pain and temperature information) from the left side of the body.

The right ventroposteromedial (VPM) nucleus of the thalamus (choice F) receives all sensory information from the left side of the face.

A patient has a tiny (0.2 cm), but exquisitely painful tumor under the nail of her index finger. Prior to surgery to remove it, local anesthetic block to a branch of which of the following nerves would be most likely to achieve adequate anesthesia?

A. Axillary nerve

B. Median nerve

C. Musculocutaneous nerve

D. Radial nerve

E. Ulnar nerve

Explanation:

The correct answer is B. The tumor in question is probably a glomus tumor, which is a benign tumor notorious for producing pain far out of proportion to its small size. The question is a little tricky (but important clinically for obvious reasons) because it turns out that the most distal aspect of the dorsal skin of the fingers, including the nail beds, is innervated by the palmar digital nerves rather than the dorsal digital nerves. Specifically, the median nerve through its palmar digital nerves supplies the nail beds of the thumb, index finger, middle finger, and half of the ring finger.

The axillary nerve (choice A), musculocutaneous nerve (choice C), and radial nerves (choice D) do not supply the nail beds.

The radial nerve does supply the more proximal skin of the back of the index finger. The ulnar nerve (choice E) supplies the nail beds of the small and half of the ring finger.

A physician asks a patient to hold her right upper arm close to her lateral chest wall, and bend the arm at the elbow so that the palm is facing upward. The physician then directs the patient to turn her hand so that the palm faces downward, without bending her wrist. This maneuver causes discomfort to the patient, which the physician notes as pain on

A. abduction of the forearm

B. adduction of the forearm

C. flexion of the forearm

D. pronation of the forearm

E. supination of the forearm

Explanation:

The correct answer is D. When the forearm is rotated from anatomic position so that the palm faces posteriorly, the forearm is said to be pronated.

Abduction (choice A) raises the arm to a horizontal position away from the body; adduction (choice B) is the reverse.

Flexion (choice C) brings the arm or forearm forward, in front of the plane of the body.

Rotation of the forearm so that the palm faces forward (i.e., into anatomic position) is referred to as supination (choice E).

A 24-year-old construction worker presents to his physician after an injury on the job. Physical examination is remarkable for marked flexion of the ring and little fingers of the left hand. Which of the following additional findings would most likely be found on physical examination?

A. Loss of sensation on the back of the thumb

B. Loss of sensation on the palmar side of the forefinger

C. Wasting of the dorsal interosseous muscles

D. Wasting of the thenar eminence

E. Wrist drop

Explanation:

The correct answer is C. Clawing of the ring, forefinger and little fingers is characteristic of an ulnar nerve lesion. Ulnar nerve lesions can also produce wasting of the hypothenar eminence and dorsal interosseous muscles. The latter causes "guttering" between the extensor tendons on the back of the hand. Ulnar lesions also cause loss of sensation to the back of the little finger and half of the ring finger.

Sensation on the back of the thumb (choice A) is provided by the radial nerve.

Sensation on the palmar side of the forefinger (choice B) is provided by the median nerve.

Wasting of the thenar eminence (choice D) is associated with lesions of the median nerve.

"Wrist drop" (choice E) is associated with lesions of the radial nerve.

A 43-year-old man presents complaining of pain in the groin. On examination, his physician palpates a bulge in the region of the superficial inguinal ring, which he diagnoses as a direct inguinal hernia. The hernial sac most likely

A. is covered by all three layers of the spermatic fascia

B. passes medial to the inferior epigastric artery

C. passes medial to the lateral border of the rectus abdominis muscle

D. passes posterior to the inguinal ligament

E. passes through the deep inguinal ring

Explanation:

The correct answer is B. Direct inguinal hernias enter the inguinal canal by tearing through the posterior wall of that structure. The typical location for this type of hernia is through the inguinal triangle, bounded laterally by the inferior epigastric artery, medially by the lateral border of the rectus abdominis, and inferiorly by the inguinal ligament. Direct inguinal hernias pass medial to the inferior epigastric artery, whereas indirect inguinal hernias pass lateral to the inferior epigastric artery because the deep inguinal ring is lateral to the artery.

Indirect inguinal hernias are covered by all three layers of the spermatic fascia (choice A). Direct inguinal hernias are covered by fewer than all three layers because the direct inguinal hernia tears through one or more layers of fascia as it emerges though the abdominal wall.

The lateral border of the rectus abdominis muscle (choice C) forms the medial border of the inguinal triangle. All inguinal hernias pass lateral to the rectus abdominis.

Femoral hernias pass posterior to the inguinal ligament (choice D). Inguinal hernias emerge through the superficial inguinal ring, which is superior to the inguinal ligament. Inguinal hernias that descend below the inguinal ligament pass anterior to the ligament.

Indirect inguinal hernias pass through the deep inguinal ring (choice E); direct inguinal hernias do not. Both types of inguinal hernias pass through the superficial inguinal ring.

A 12-year-old is seen by a pediatrician for a severe sore throat. Physical examination reveals a brightly erythematous patch in the upper posterior pharynx. Which of the following cranial nerves would most likely carry the pain sensation associated with this lesion?

A. III

B. V

C. VII

D. IX

E. X

Explanation:

The correct answer is D. The glossopharyngeal nerve (IX) carries general somatic sensation from the posterior part of the upper pharynx, eustachian tube, and posterior one-third of the tongue. It also carries taste sensation from the posterior one-third of the tongue, and conveys afferent fibers from the carotid sinus baroreceptors and carotid body chemoreceptors, and efferent fibers to the stylopharyngeus muscle.

The oculomotor nerve (III, choice A) supplies the extraocular muscles (superior, inferior, and medial recti, and inferior oblique) and levator palpebrae superioris muscle, and sends parasympathetic fibers to the ciliary muscle and iris.

The trigeminal nerve (V, choice B) receives somatic sensation information from the face, lips, gums, teeth, palate, and anterior two-thirds of the tongue.

The facial nerve (VII, choice C) carries taste sensation from the anterior two-thirds of the tongue. It supplies motor innervation to the muscles of facial expression and to the stapedius muscle, and sends parasympathetic fibers to the lacrimal, submandibular, and sublingual glands.

The vagus nerve (X, choice E) carries sensation from the lower part of the posterior pharynx, larynx, trachea, and esophagus. It supplies parasympathetic innervation to the thoracic and abdominal viscera to the left colic flexure.

A 30-year-old female presents for a check-up. She jogs 2-3 miles daily but states that recently she has had vague lower back pain that radiates down her leg to her foot. During examination her gait is found to be normal. Skin testing reveals sensation of her foot to be decreased laterally. Her patellar reflex is normal but her Achilles (ankle jerk) reflex is decreased. Muscle strength testing shows slight hamstring weakness. Which of the following nerve roots is most likely affected?

A. L2

B. L3

C. L4

D. L5

E. S1

Explanation:

The correct answer is E. The S1 nerve root innervates the peroneus longus and brevis via the superficial peroneal nerve. The peronei can be tested by having the patient flex and evert the foot against opposition. S1 also innervates part of the hamstring (biceps femoris) via the tibial portion of the sciatic nerve. This accounts for the slight hamstring weakness. The S1 reflex, the Achilles tendon reflex, is mediated through the gastrocnemius muscle. It is tested by stretching the tendon and eliciting an involuntary plantar reflex. The S1 dermatome is on the lateral foot.

L2 (choice A) and L3 (choice B) are not associated with individual reflexes and so their integrity can be evaluated only by muscle and sensory tests. L2, L3, and L4 form the femoral nerve. This innervates the quadriceps muscles and is responsible for hip flexion. The hip adductors are also L2, L3, and L4. The L2 and L3 dermatomes are on the anterior thigh.

L4 (choice C) is tested with the patellar reflex. Although L2, L3, and L4 contribute, it is primarily L4. The L4 dermatome is on the medial aspect of the foot. Muscle testing is done through the deep peroneal nerve (L4). This innervates the tibialis anterior and can be tested by resistance to dorsiflexion and inversion.

L5 (choice D) cannot be tested easily via a reflex response. The tibialis posterior reflex is mediated by L5, but this reflex is difficult to elicit and to interpret. Motor testing is via the peroneus longus and brevis muscles, which are innervated by the superficial peroneal nerve. To test this, the patient plantar flexes and everts the foot against opposition. The dermatome for L5 is the central dorsum of the foot.

A 26-year-old male is stabbed in the left chest during a bar brawl. Several days after he is treated, he

returns to the doctor complaining of decreased function in his left arm. Physical exam reveals a winged left scapula and an inability to raise his left arm above the horizontal. Which of the following nerves is most likely affected?

A. Axillary nerve

B. Long thoracic nerve

C. Lower subscapular

D. Suprascapular nerve

E. Thoracodorsal nerve

Explanation:

The correct answer is B. The serratus anterior, innervated by the long thoracic nerve, is responsible for stabilization of the scapula during abduction of the arm from 90 to 180 degrees. When the long thoracic nerve is damaged, it is difficult to elevate the arm above the horizontal. This nerve arises from C5, 6, and 7. Remember: "winged scapula" is a classic clue for long thoracic nerve injury.

Note that the supraspinatus muscle, innervated by the suprascapular nerve (choice D), is responsible for abducting the arm from 0 degrees to about 30 degrees. The rest of the motion to 180 degrees is performed by the deltoid muscle, which is innervated by the axillary nerve (choice A). However, the motion from 90 degrees to 180 degrees also requires a stable scapula and therefore depends on the long thoracic nerve.

The axillary nerve (choice A) is a branch of the posterior cord of the brachial plexus (C5, C6). It is particularly susceptible to injury in shoulder dislocations that displace the humeral head or in fracture of the surgical neck of the humerus. A poorly placed crutch may also damage this nerve, causing paralysis of the teres minor and deltoid muscles. Arm abduction is impaired and there is associated loss of sensation over the lower half of the deltoid.

The lower subscapular nerve (choice C) innervates the teres major, which is responsible for adducting and medially rotating the arm. It is a branch of the posterior cord (C5, C6) of the brachial plexus.

The suprascapular nerve (choice D) innervates the supraspinatus and infraspinatus muscles, which are responsible for abduction and lateral rotation of the arm. The nerve is derived from the C5 and C6 nerve roots.

The thoracodorsal nerve (choice E) innervates the latissimus dorsi muscle, which is responsible for adduction and extension of the arm. The nerve arises from the posterior cord (C7, C8) of the brachial plexus.

A 15-year-old girl is brought to the emergency room after attempting suicide following a fight with her parents. She has cut her wrist with a razor blade, and severed the flexor carpi radialis and palmaris longus tendons. The nerve most at risk from her injury arises from which part(s) of the brachial plexus?

A. Lateral and medial cords

B. Lateral cord

C. Middle and lower trunks

D. Posterior cord

E. Upper and middle trunks

Explanation:

The correct answer is A. The nerve in question is the median nerve, which lies between the palmaris longus and flexor carpi radialis tendons on the anterior aspect of the forearm. The median nerve is formed from both the lateral and medial cords of the brachial plexus.

The musculocutaneous nerve is the nerve formed from the lateral cord alone (choice B).

The middle and lower trunks (choices C and E) of the brachial plexus do not give rise to any nerves. The upper trunk (choice E) gives rise to the nerve to subclavius and the suprascapular nerve.

The axillary and radial nerves are formed from the posterior cord (choice D).

An aneurysm of the axillary artery within the axilla is most likely to compress which of the following neural structures?

A. Axillary nerve

B. Long thoracic nerve

C. Lower trunk of the brachial plexus

D. Medial cord of the brachial plexus

E. Musculocutaneous nerve

Explanation:

The correct answer is D. Within the axilla, the axillary artery is within the axillary sheath and is surrounded by the three cords of the brachial plexus, which are also within the axillary sheath. An aneurysm of the axillary artery may compress any of the three cords.

The axillary nerve (choice A) is a branch of the posterior cord that leaves the axillary sheath, then exits the axilla through the quadrangular space to innervate the deltoid muscle.

The long thoracic nerve (choice B) is not within the axillary sheath. It arises from the anterior rami of the fifth, sixth, and seventh cervical nerves in the neck and courses along the chest wall to innervate the serratus anterior muscle.

The lower trunk of the brachial plexus (choice C) is not in the axilla. It is formed in the neck from the anterior rami of the eighth cervical and first thoracic spinal nerves.

The musculocutaneous nerve (choice E) is not within the axillary sheath. It arises as a branch of the lateral cord of the brachial plexus and enters the arm to innervate the muscles of the anterior compartment of the arm.

A 15-year-old girl is brought into the emergency room with severe abdominal pain and a fever. Laboratory examination is remarkable for an elevated white blood cell count and a pregnancy test is positive. Upon questioning, it is determined that she attempted to terminate her pregnancy by inserting a sharp object into her vagina. The physician determines that the wall of the

posterior fornix of the vagina has been penetrated. Into what region did the sharp object penetrate?

A. Deep perineal pouch

B. Ischioanal space

C. Rectouterine space

D. Rectovesical space

E. Vesicouterine space

Explanation:

The correct answer is C. The posterior fornix is in contact with the floor of the rectouterine space. The rectouterine space is the lowest part of the peritoneal cavity in the female pelvis. The patient has introduced bacteria into the peritoneal cavity by the penetration of the sharp object, producing sepsis.

The deep perineal pouch (choice A) is the middle layer of the urogenital diaphragm containing the sphincter urethrae muscle. The vagina passes through this region but the posterior fornix is not related to it.

The ischioanal space (choice B) is below and lateral to the pelvic diaphragm. The vagina does not pass through this space.

The rectovesical space (choice D) is the region in the peritoneal cavity of the male pelvis between the urinary bladder and the rectum. This space does not exist in the female pelvis.

The vesicouterine space (choice E) is the region within the peritoneal cavity of the female pelvis between the urinary bladder and the uterus. This space is not related to the posterior fornix of the vagina.

As part of a complete neurological examination, a medical student takes a cotton-tipped applicator and touches the patient's left eye with a thin wisp of cotton as the patient looks to the right. The patient closes both of his eyelids in response. Which of the following cranial nerves is responsible for the motor limb of this reflex?

A. Abducens

B. Facial

C. Optic

D. Trigeminal

E. Trochlear

Explanation:

The correct answer is B. The corneal reflex is tested by touching the cornea of one eye with a cotton wisp; this causes both eyes to close. The afferent, or sensory, component of the corneal reflex is mediated by the ophthalmic division of the ipsilateral trigeminal nerve (V-1). The efferent, or motor, component is mediated by the facial nerve (CN VII), bilaterally.

The abducens nerve (CN VI; choice A) innervates the lateral rectus muscles, which abduct the eyes.

The optic nerve (CN II; choice C) is responsible for vision, providing the afferent limb of the pupillary light reflex.

The trigeminal nerve (CN V; choice D) is responsible for the afferent limb of the corneal reflex. It also innervates the muscles of mastication and provides sensory innervation to the face.

The trochlear nerve (CN IV; choice E) innervates the superior oblique muscles, which depress, intort, and abduct the eyes.

A patient is transported to the emergency room with a knife wound to the right fifth intercostal space at the midaxillary line. Which of the following structures is likely to have been damaged?

A. Liver

B. Right atrium

C. Right pulmonary artery

D. Superior vena cava

E. Upper lobe of right lung

Explanation:

The correct answer is A. Any perforating wound occurring below the level of the fourth intercostal space on the right side may damage the liver, which is protected by the rib cage, although it is an abdominal organ lying inferior to the diaphragm.

At its most lateral aspect, the right atrium (choice B) forms the right border of the heart, which extends from the 3rd costal cartilage to the 6th costal cartilage just to the right of the sternum.

The right pulmonary artery (choice C) enters the hilus of the lung at the level of the T5 vertebra. Since the ribs are angled downward as they pass forward, this entry occurs above the level of the 5th intercostal space at the midaxillary line.

The superior vena cava (choice D) enters the right atrium at the level of the third costal cartilage.

At the midaxillary line, the oblique fissure of the right lung (choice E) passes between the inferior and middle lobes.